AIRS Monthly Mean Data Analysis and Current Climatology in Giovanni

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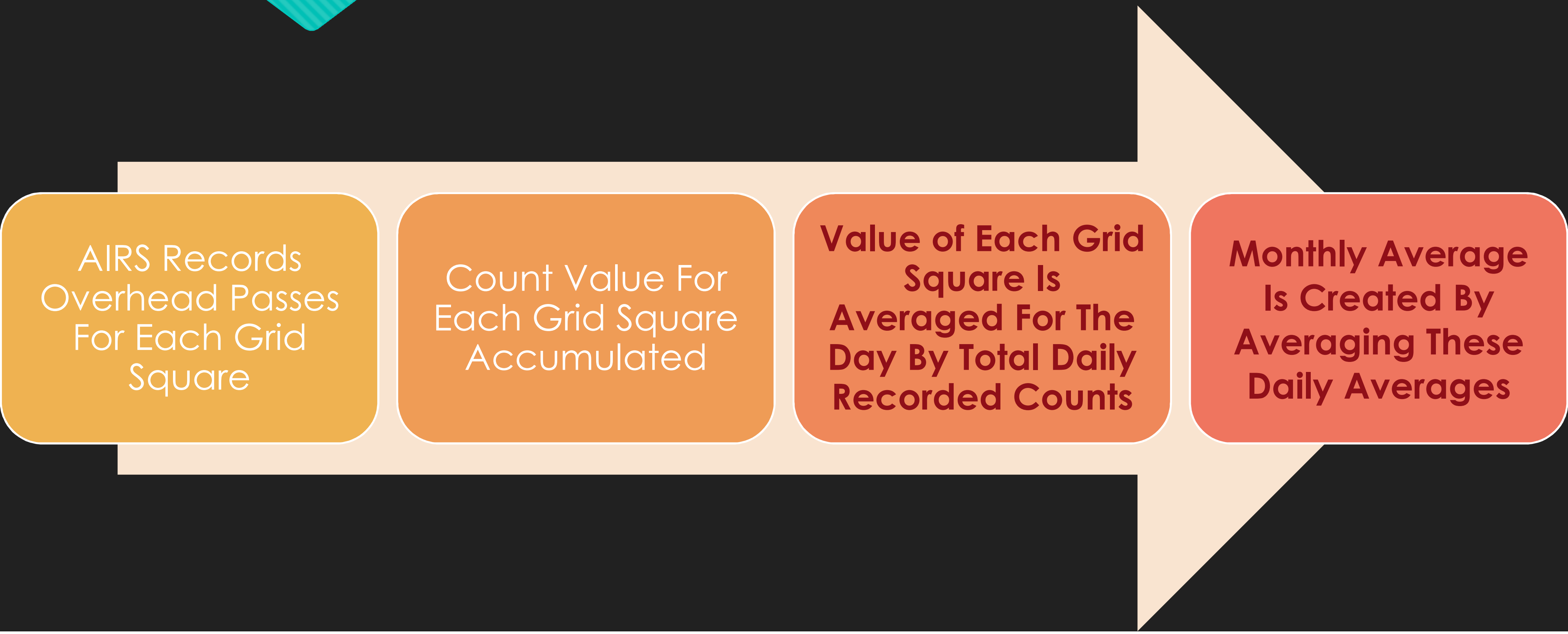
Background

- Climate varies naturally on nearly all time and space scales.
- **AIRS (Atmospheric Infrared Sounder) is stable, mature, and well-suited to analyze the climate in the past 14 years.**
- We define an AIRS climatology as the average of all monthly mean geophysical variables for each month.
- **To do this accurately we need to have the best possible monthly mean product.**

Weighted Method (AIRX3STM)

1. AIRS Records Overhead Passes For Each Grid Square
2. Count Value For Each Grid Square Accumulated
3. **Value Of Each Count Added Together For Entire Month**
4. **Divide Value By Total Number Of Counts For Month**

Unweighted Method

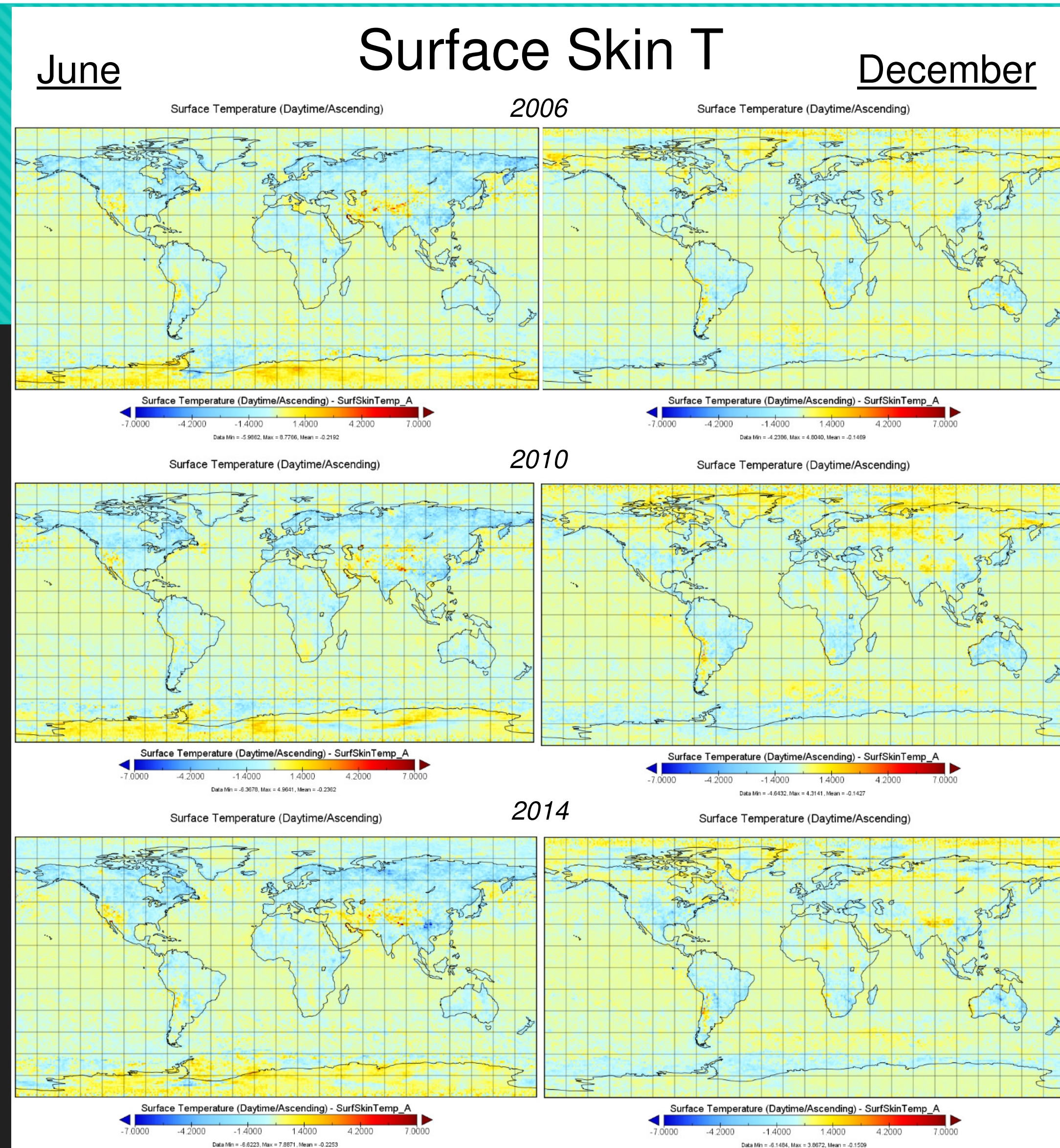


Method of Approach

- **To asses that there was a significant margin between the un-weighted and weighted algorithms, the difference between the two methods was determined for June and December of three separate years.**
- Datasets used are from AIRS/AMSU version 6 daily/monthly standard product to create difference maps.
- Assessment was done for both the Surface Air Temperature and Surface Skin Temperature variable data sets (Ascending and Decending).

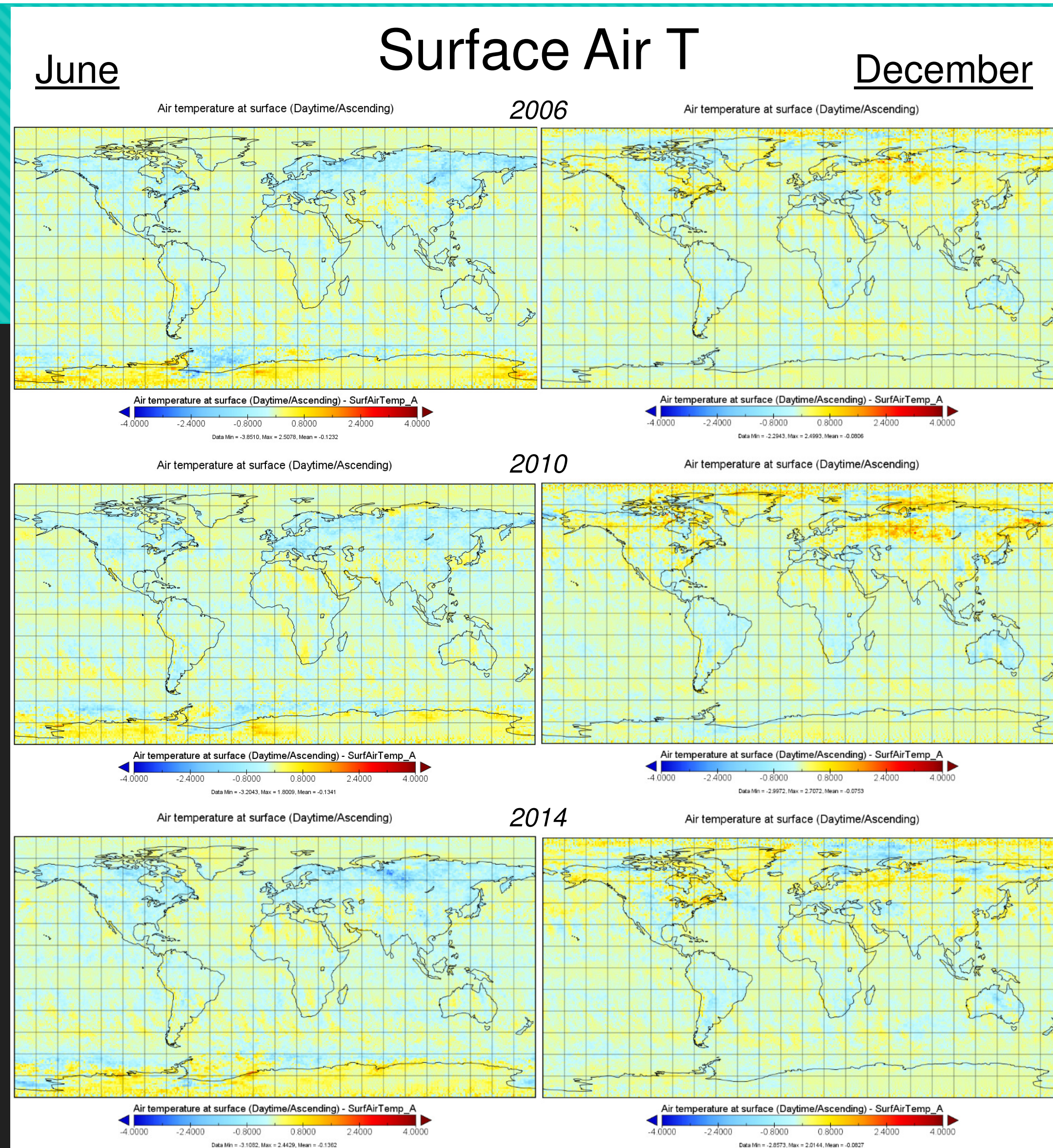
Unweighted-Weighted Ascending

Year	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
2006	***June***	-0.21	0.68	-5.99	8.78
	Dec.	-0.14	0.47	-4.24	4.80
2010	***June***	-0.24	0.66	-6.37	4.96
	Dec.	-0.12	0.53	-4.64	4.31
2014	***June***	-0.24	0.67	-6.62	7.89
	Dec.	-0.15	0.50	-6.15	3.87



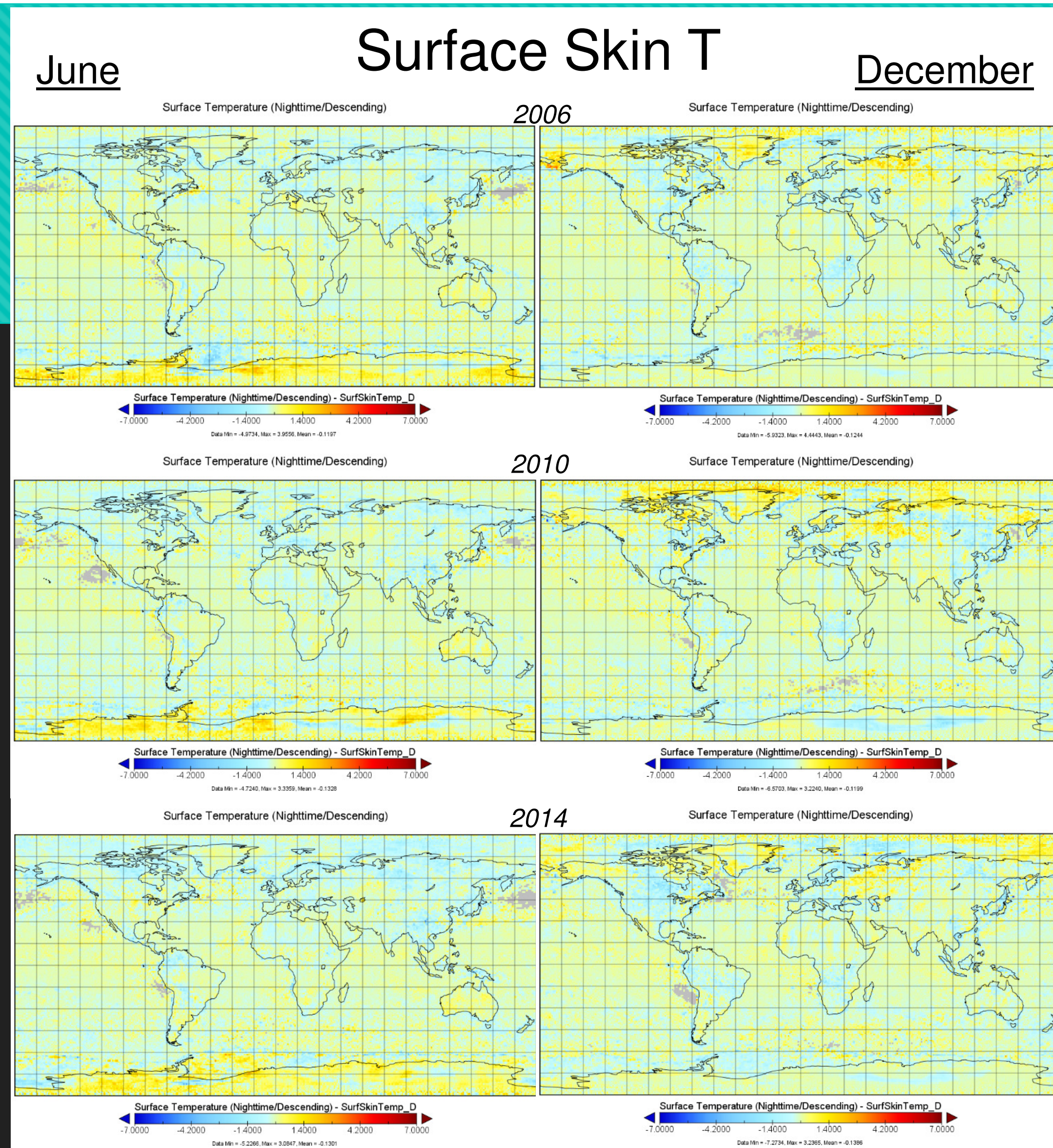
Unweighted-Weighted Ascending

Year	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
2006	***June***	-0.10	0.33	-3.85	2.51
	Dec.	-0.068	0.26	-2.29	2.50
2010	***June***	-0.11	0.30	-3.20	1.80
	Dec.	-0.052	0.32	-3.00	2.71
2014	***June***	-0.12	0.32	-3.11	2.44
	Dec.	-0.0704	0.28	-2.86	2.01



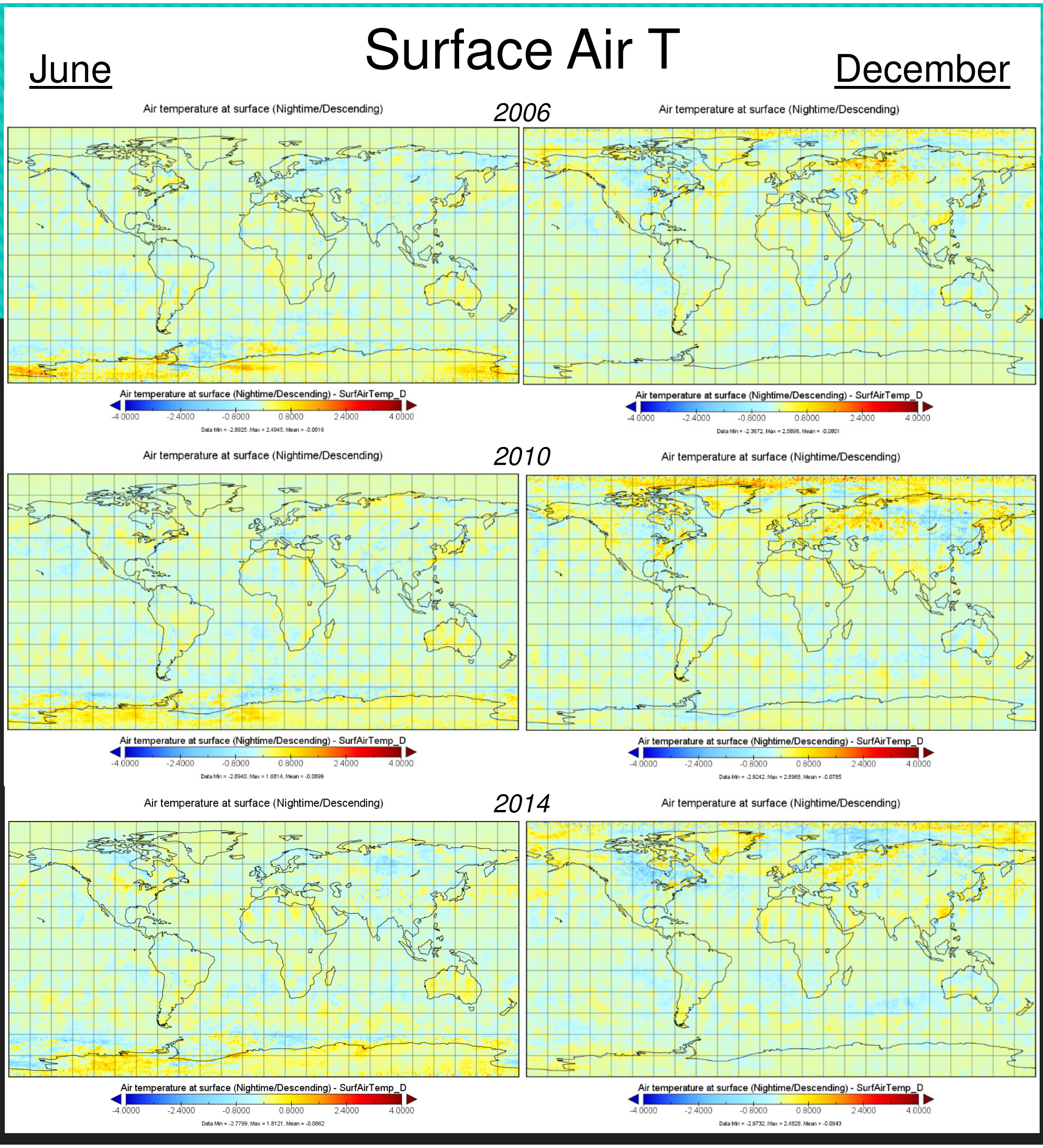
Unweighted-Weighted Descending

Year	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
2006	***June***	-0.11	0.47	-4.97	3.96
	Dec.	-0.12	0.44	-5.93	4.44
2010	***June***	-0.12	0.45	-4.72	3.34
	Dec.	-0.103	0.49	-6.57	3.22
2014	***June***	-0.13	0.46	-5.23	3.08
	Dec.	-0.14	0.46	-7.27	3.24



Unweighted-Weighted Descending`

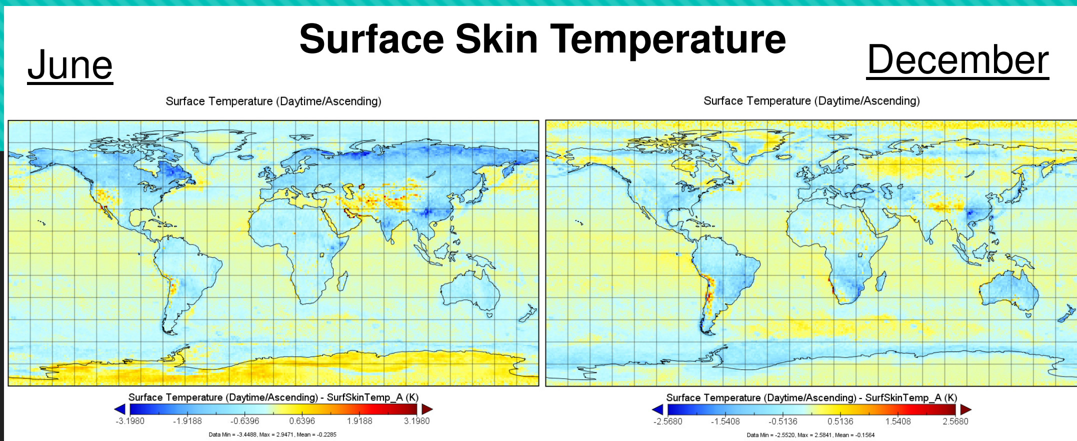
Year	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
2006	***June***	-0.058	0.27	-2.89	2.49
	Dec.	-0.069	0.27	-2.37	2.59
2010	***June***	-0.064	0.25	-2.89	1.68
	Dec.	-0.048	0.34	-2.92	2.90
2014	***June***	-0.067	0.26	-2.78	1.81
	Dec.	-0.086	0.31	-2.97	2.48

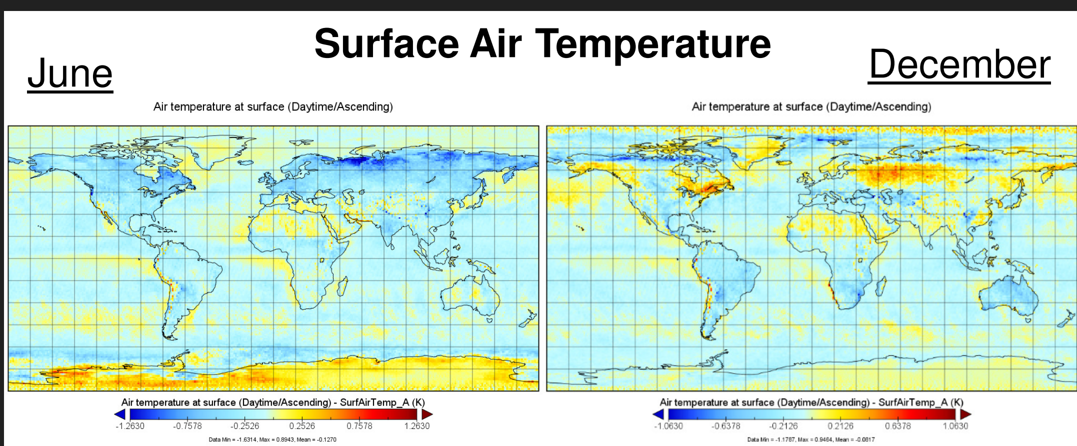


Results

- **There is a consistent, notable, difference between the unweighted monthlies and the existing weighted monthlies, with the largest differences for Surface Skin around 8 degrees K and for Surface Air around 5 degrees K.**
- The surface skin maps overall showed higher T differences than the surface air maps, which might be explained by the higher heating rate that land has compared to air.
- **The unweighted monthlies were consistently warmer near the winter polar regions. (June: South Pole, December: North Pole)**

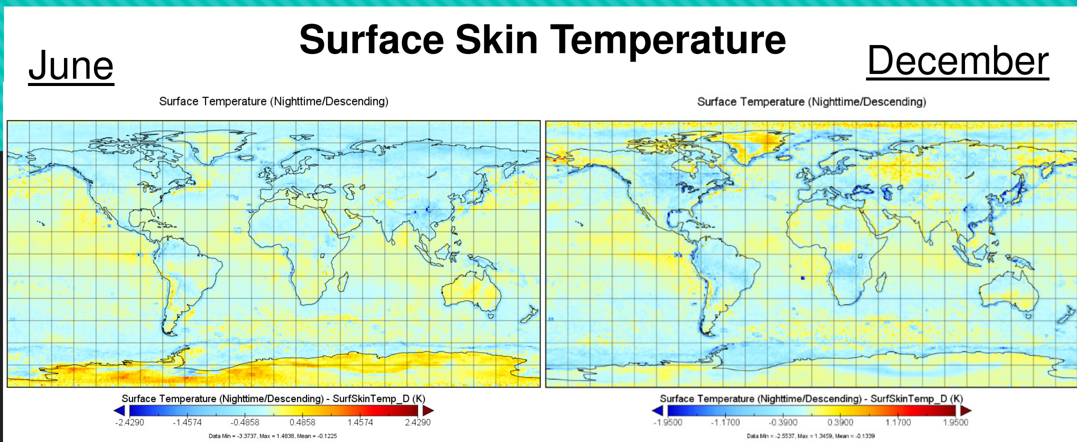
UW-W Climatology Diff. Ascending

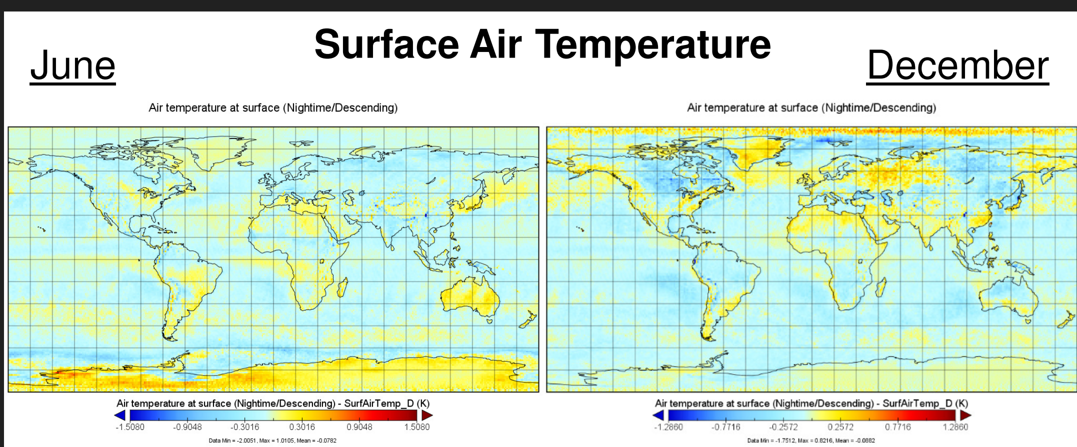




Variable	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
Surf. Skin	***June***	-0.244	0.572	-3.45	2.95
	Dec.	-0.158	0.340	-2.55	2.58
Surf. Air	***June***	-0.119	0.266	-1.63	0.89
	Dec.	-0.0744	0.157	-1.18	0.95

UW- W Climatology Diff. Descending



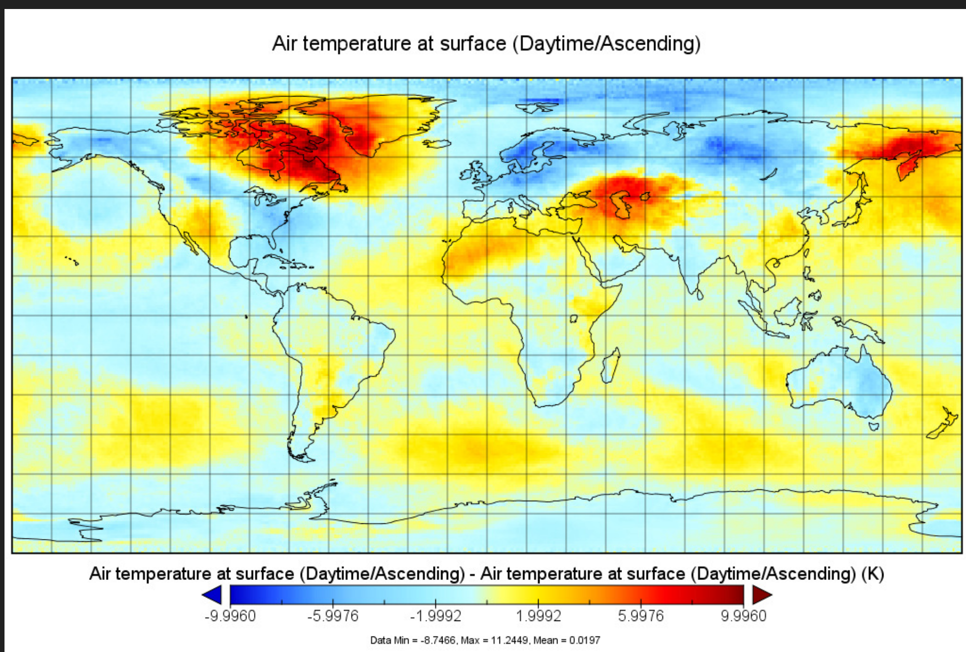


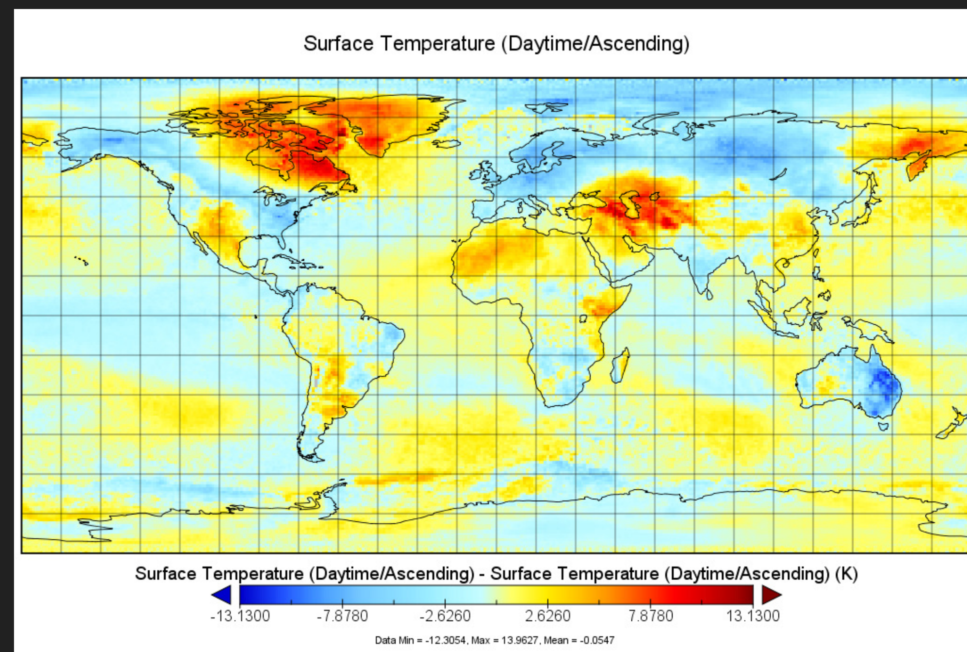
Variable	Month	Mean Diff.	RMS Diff.	Min °K	Max °K
Surf. Skin	***June***	-0.140	0.338	-3.37	1.48
	Dec.	-0.135	0.277	-2.55	1.35
Surf. Air	***June***	-0.081	0.199	-2.01	1.01
	Dec.	-0.078	0.160	-1.75	0.82

Results, Continued

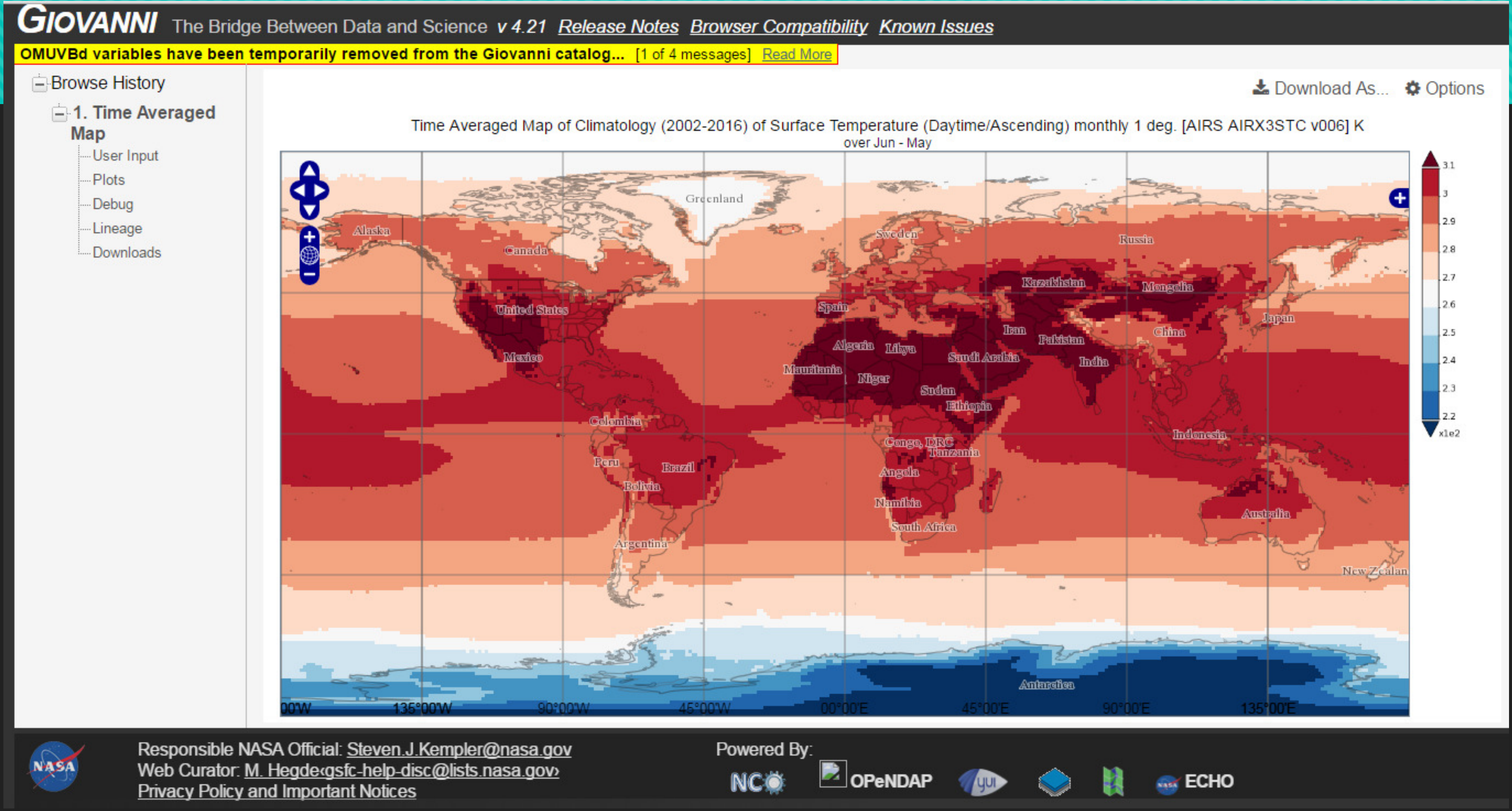
- Differences between the climatology created with un-weighted data and the climatology created with the existing AIRS weighted monthly products showed similar regional differences when compared to the monthly maps.
- The maps of the Climatologies show differences up to 3 degrees K.
- The regional T differences are much less concentrated in the months between June and December

Examples of Anomaly Maps Created from the Unweighted Climatology and Monthly Data (From December 2010)

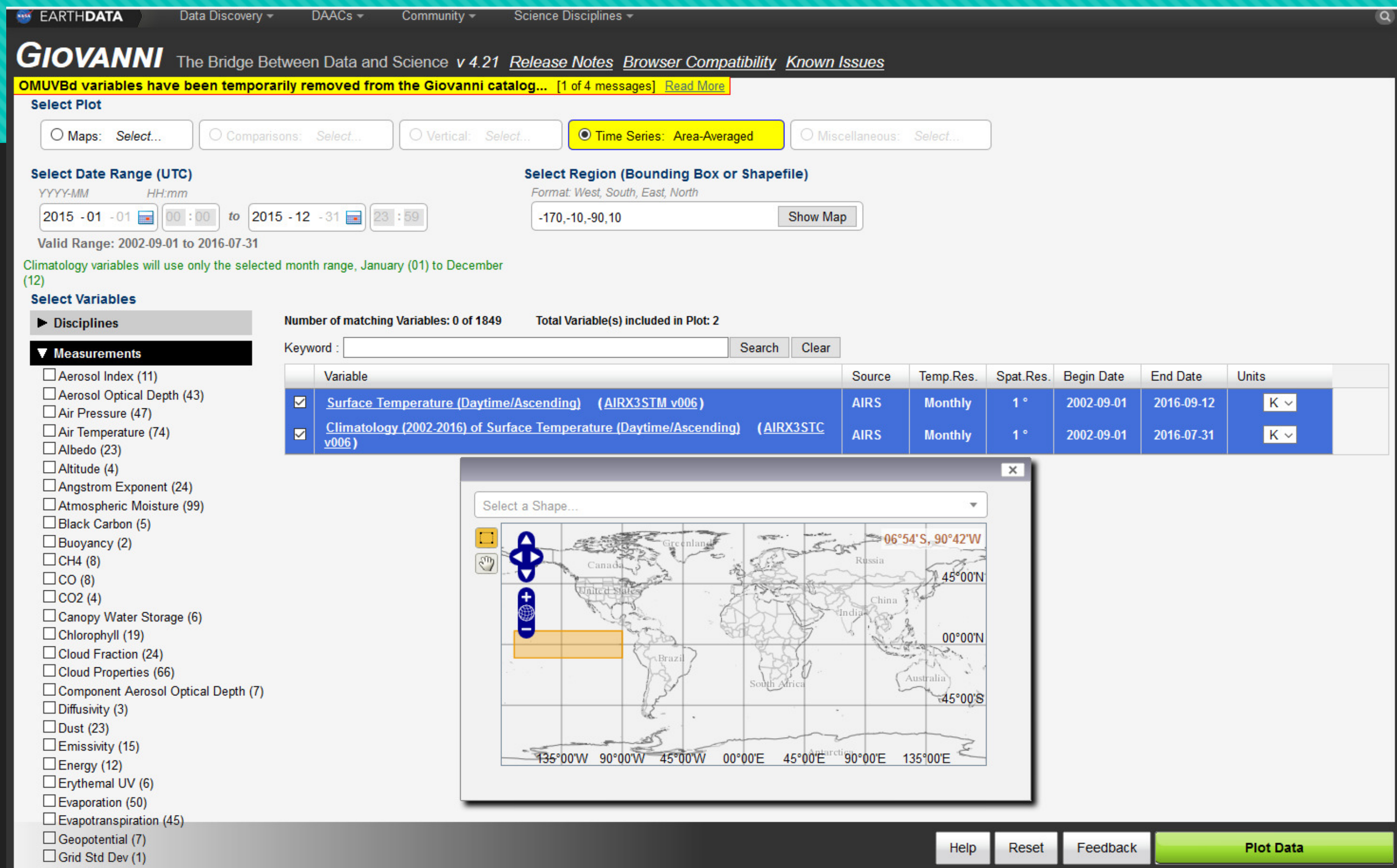




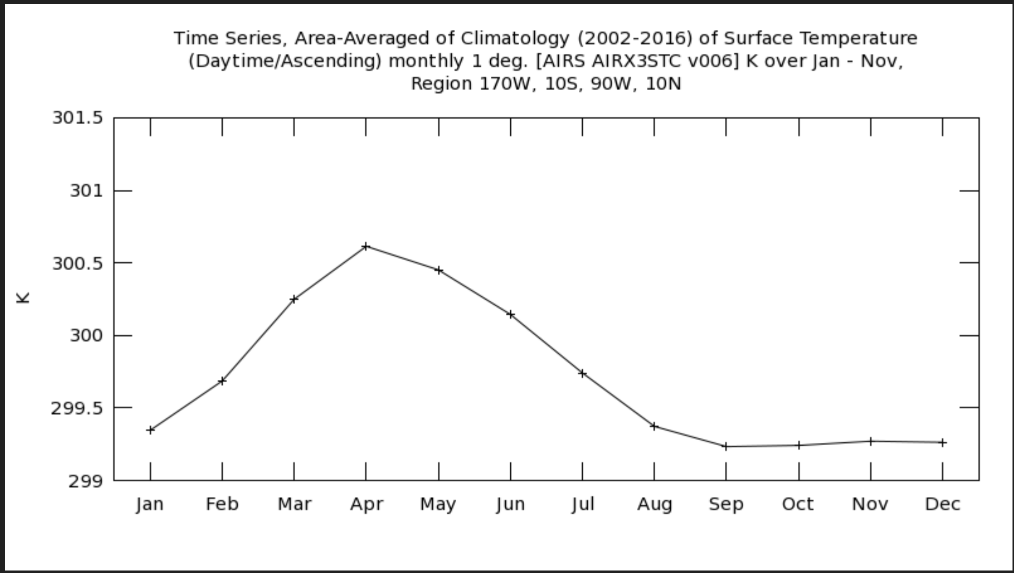
Sample AIRS Climatology Plot on Giovanni



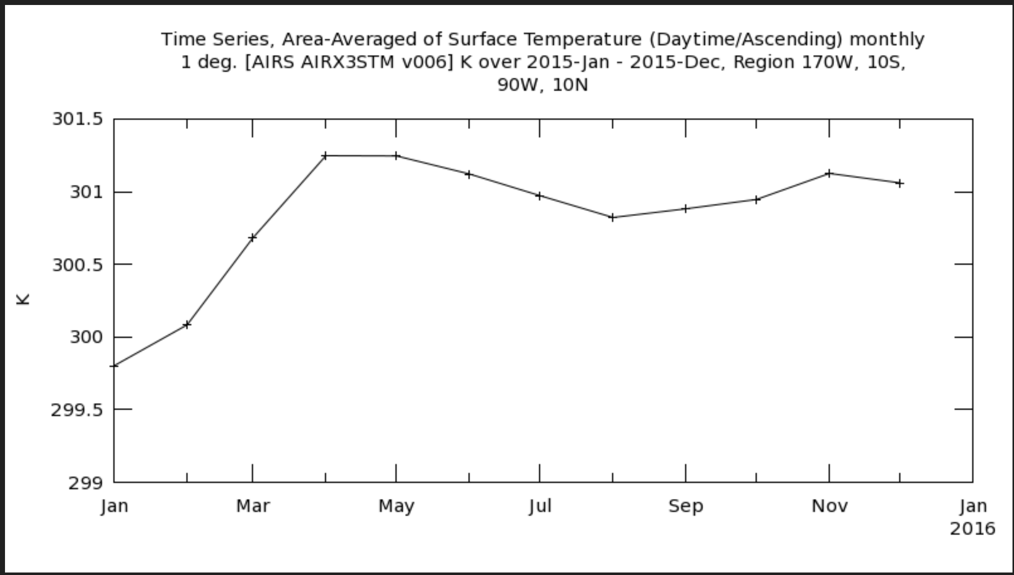
Using AIRS Climatology to Show Indication of El Niño



Climatology Time Series



2015 Monthly Time Series



Discussion and Conclusions

- While not clear which averaging method is specifically better at this point, it is clear that more research needs to be done looking into the differences between the two that are shown here.
- **Once fully implemented into Giovanni, we will be able to generate not only visual maps of Climatologies/anomalies, but we will also be able to generate the data sets to go along with those visuals, which will allow for more in depth seasonal and regional analysis of the data.**
- By subtracting our created climatology from monthly averages we can see how our current climate is changing.
- **Analyzing the data from the trial, unweighted, climatology, the largest anomalies, both + and - , for all variables were overwhelmingly present in the (D-J-F) season of almost every year.**